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Fate and Transport of Cyanobacteria-Related Toxins and Taste-and-Odor Compounds from Upstream Reservoir Releases in the Kansas River, Kansas, September and October 2011

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Kansas River Algae Workshop

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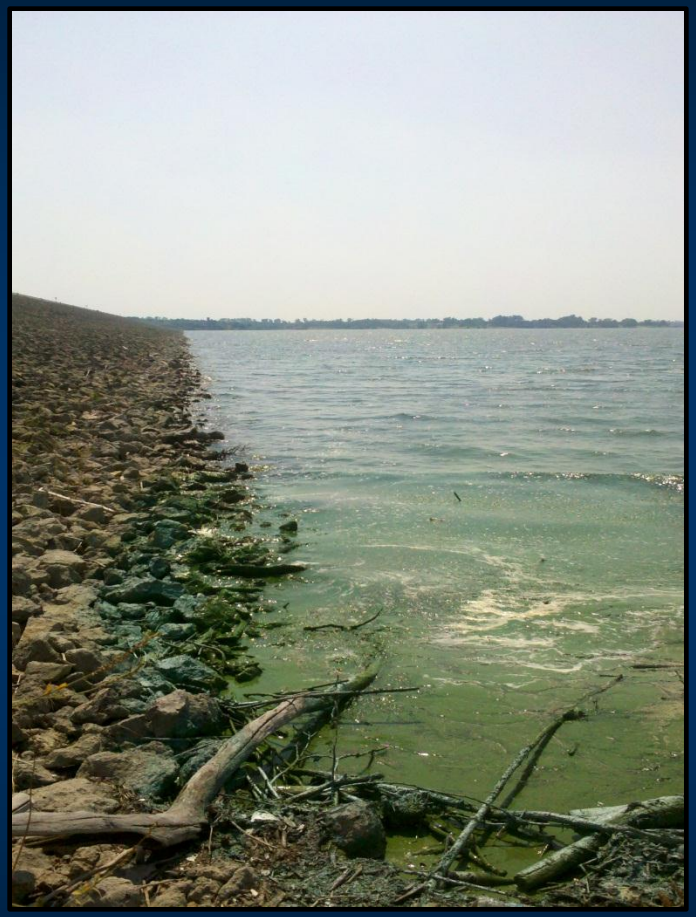
In Cooperation with the City of Lawrence, the City of Topeka, Johnson County WaterOne, the Kansas Water Office, and the Kansas Department of Health and Environment

Kansas River Study Objectives

- **Provide timely data to utilities that use the Kansas River as a source-water supply.**
- **Characterize the extent and duration of the transport of cyanobacteria and associated toxins and taste-and-odor compounds from upstream reservoirs to the Kansas River.**
- **Determine the strengths and weaknesses of the sampling plan used during this event so robust long-term plans to evaluate and provide a monitoring program for future events can be developed.**



Milford Lake, September 2011
Photo courtesy of E. Looper, USGS

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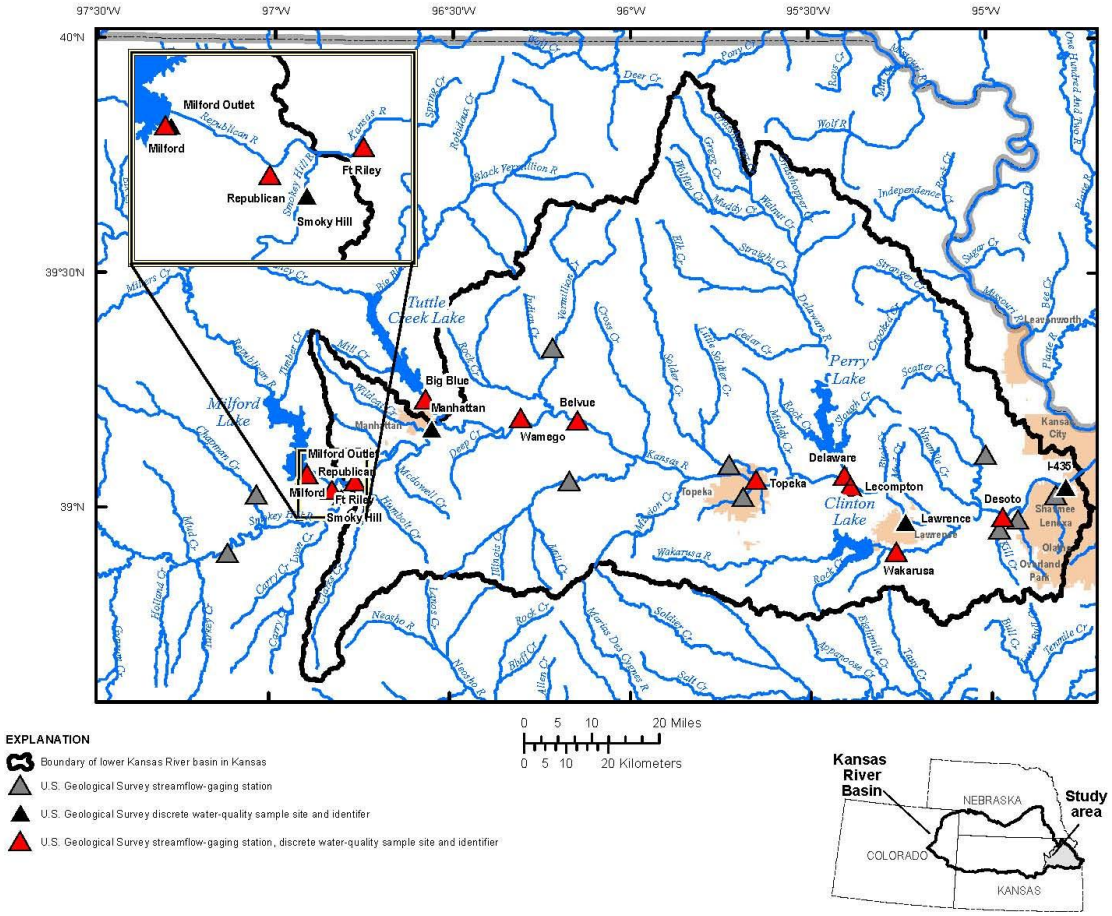
Kansas River Study Sites



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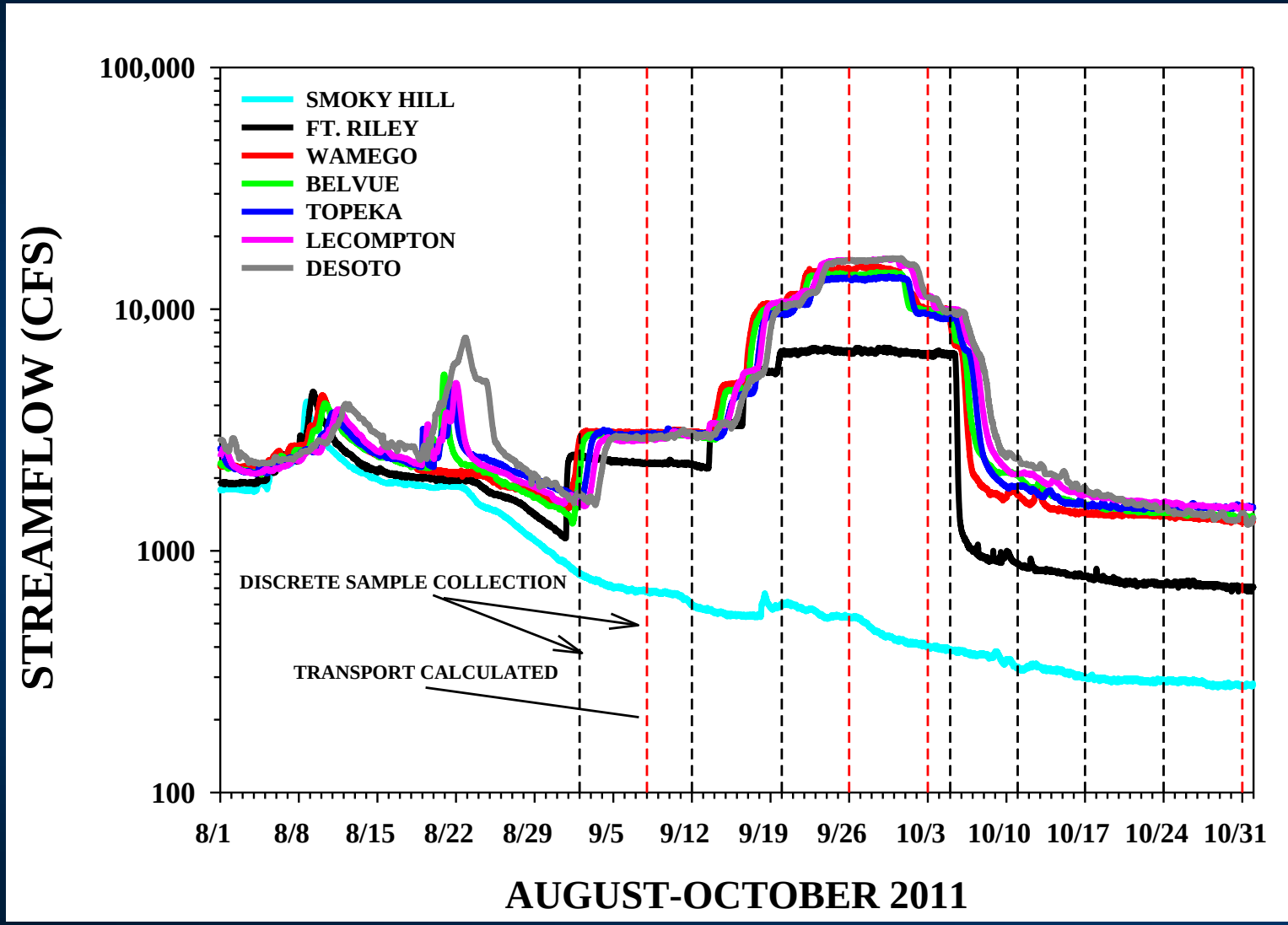
Kansas River Study Sampling Strategy

- Samples were collected weekly during September 2-October 31, 2011; the sites sampled changed weekly based on toxin and taste-and-odor results.
- Most river samples were surface grabs from the centroid of flow.
- Samples were analyzed for microcystin, geosmin, 2-methylisoborneol, chlorophyll, and phytoplankton community composition.

Milford Lake Sampling, September 2011
Photo courtesy of E. Looper, USGS

Streamflow in the Kansas River Increased by About an Order of Magnitude at Most Sites During Peak Reservoir Releases



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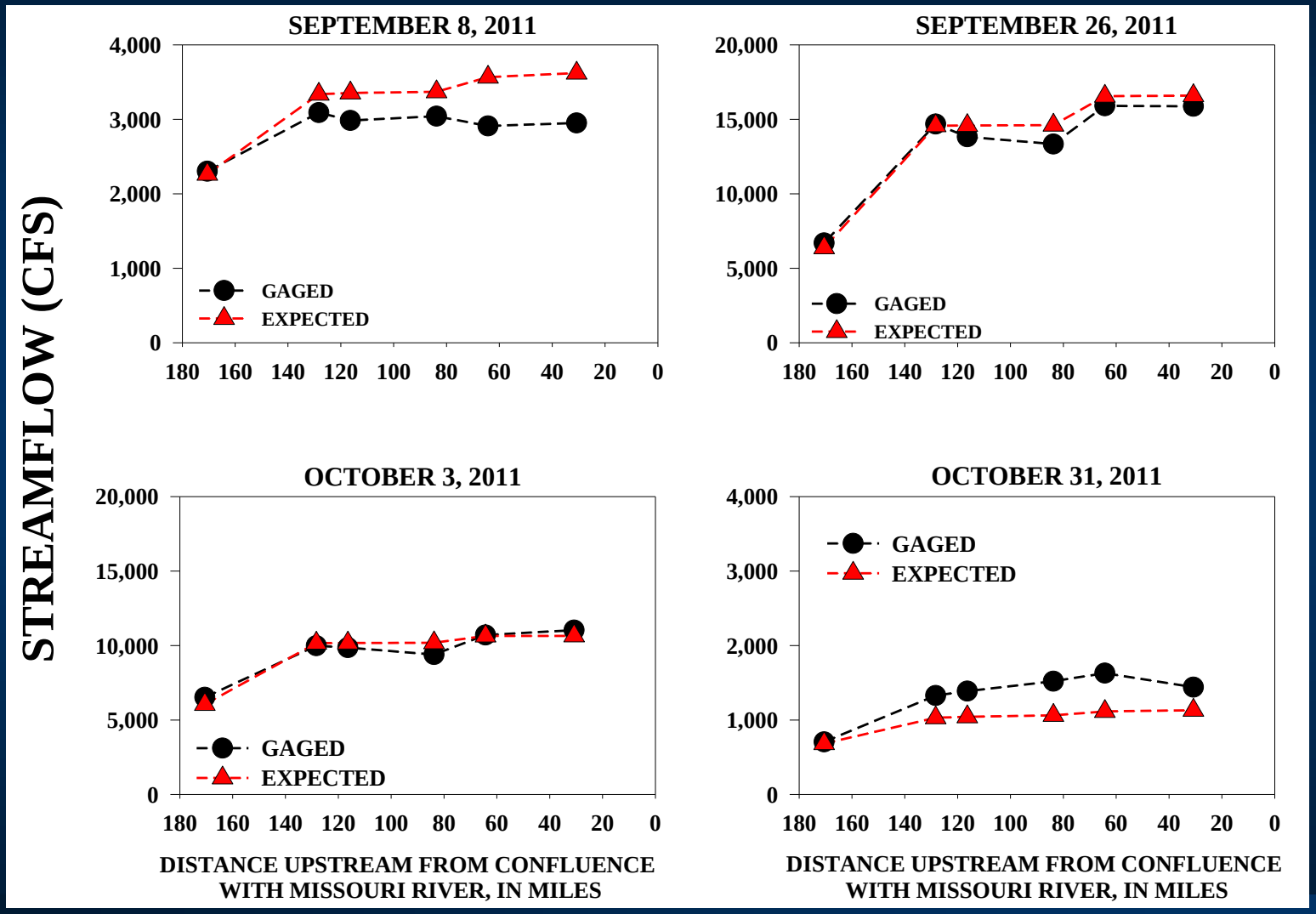
The Kansas River Lost Water as Streamflow Increased and Gained Water as Streamflow Decreased



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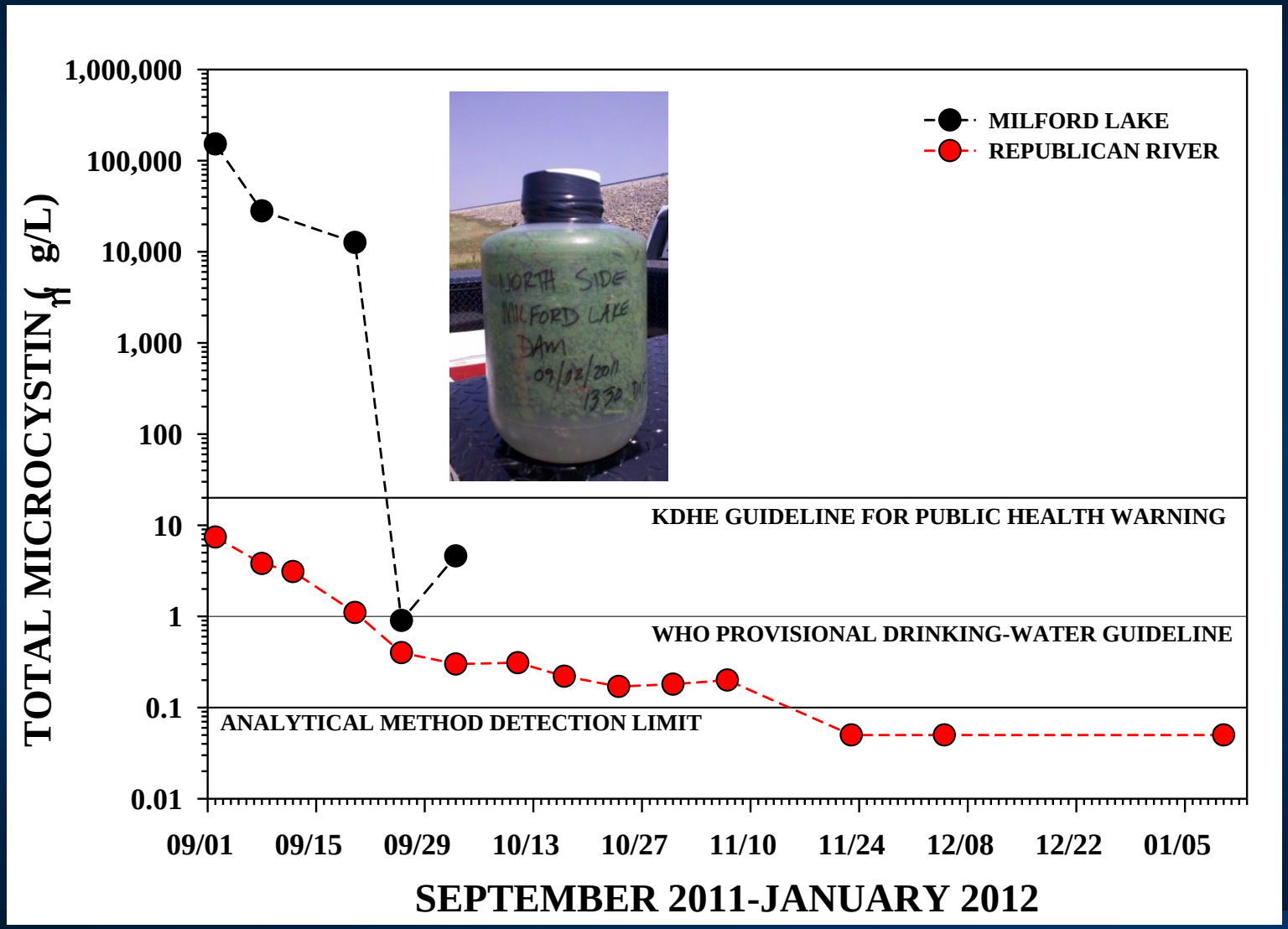
Microcystins were Detected in the Republican River, Downstream from Milford Lake, from September 2-November 7, 2011



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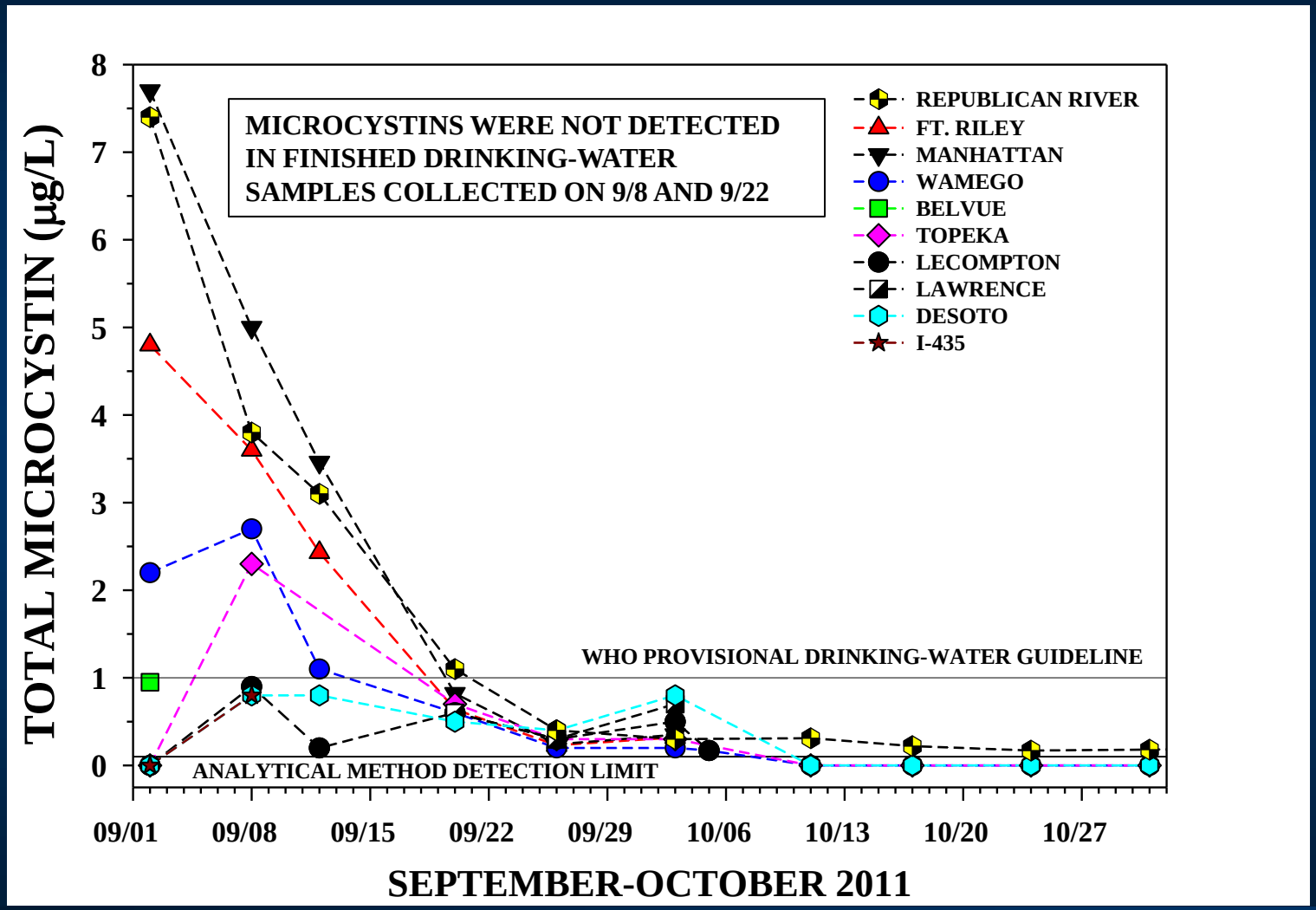
Microcystins were Detected at All Kansas River Main-Stem Sites from September 8-October 5, 2011



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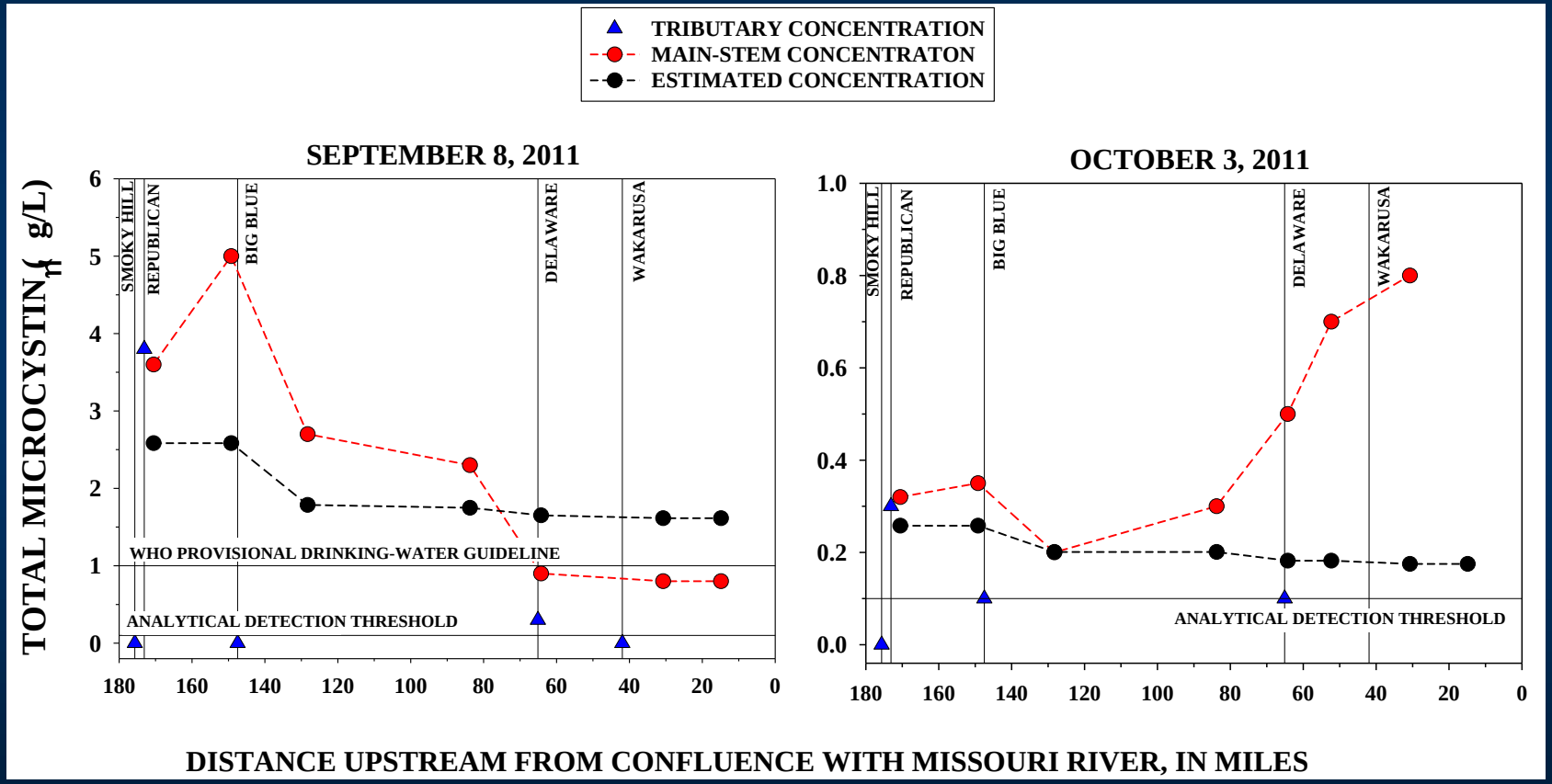
Longitudinal Patterns in Total Microcystin Concentration Suggest Simple Dilution Models Are Not Sufficient to Describe Transport in the Kansas River



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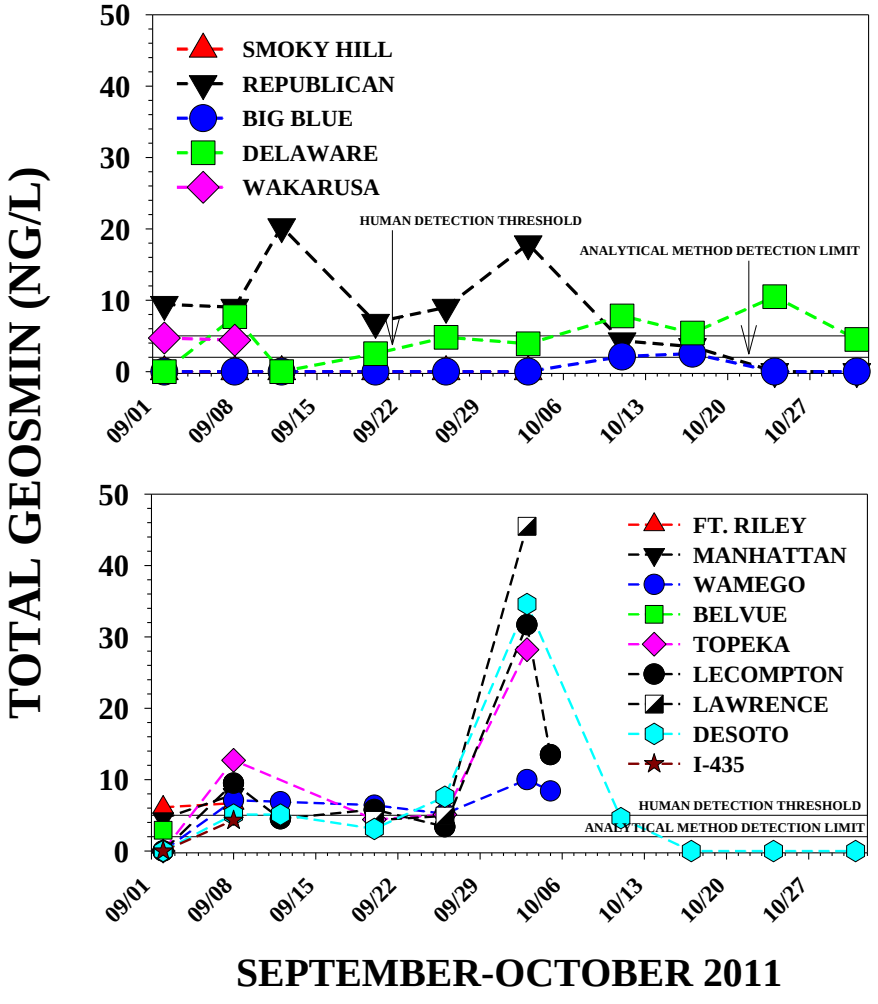
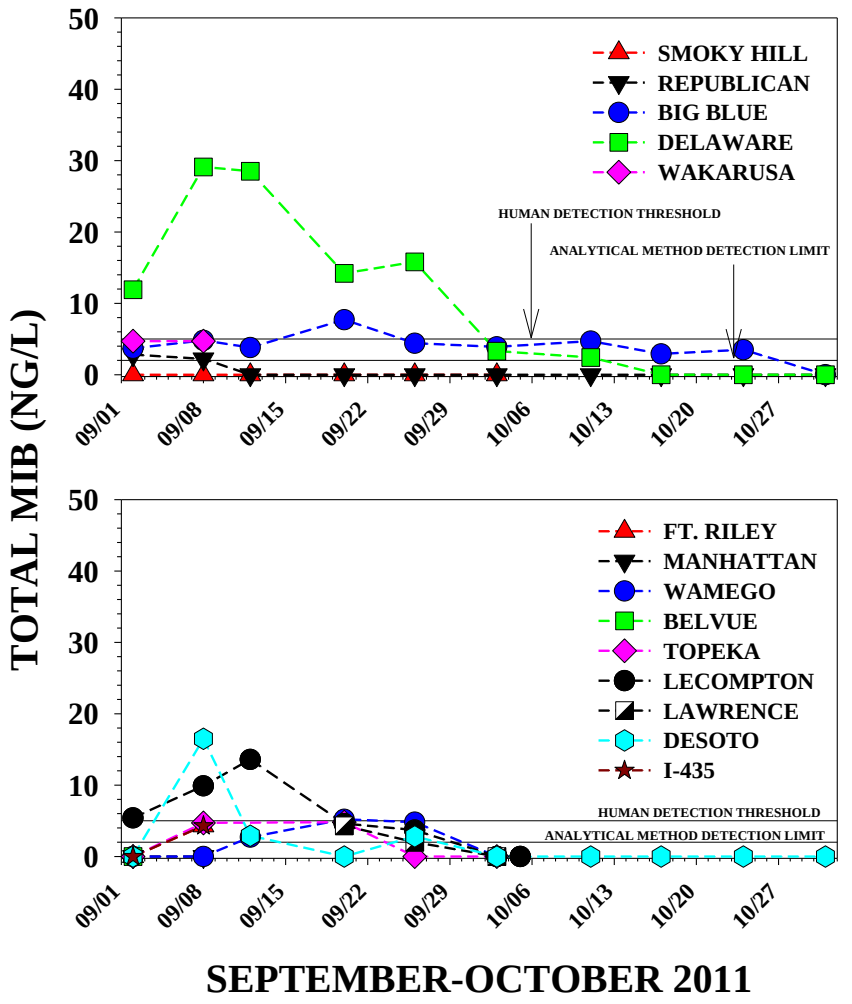
Taste and Odor Compounds Were Detected in All Reservoir Outflows and Main-Stem Kansas River Study Sites





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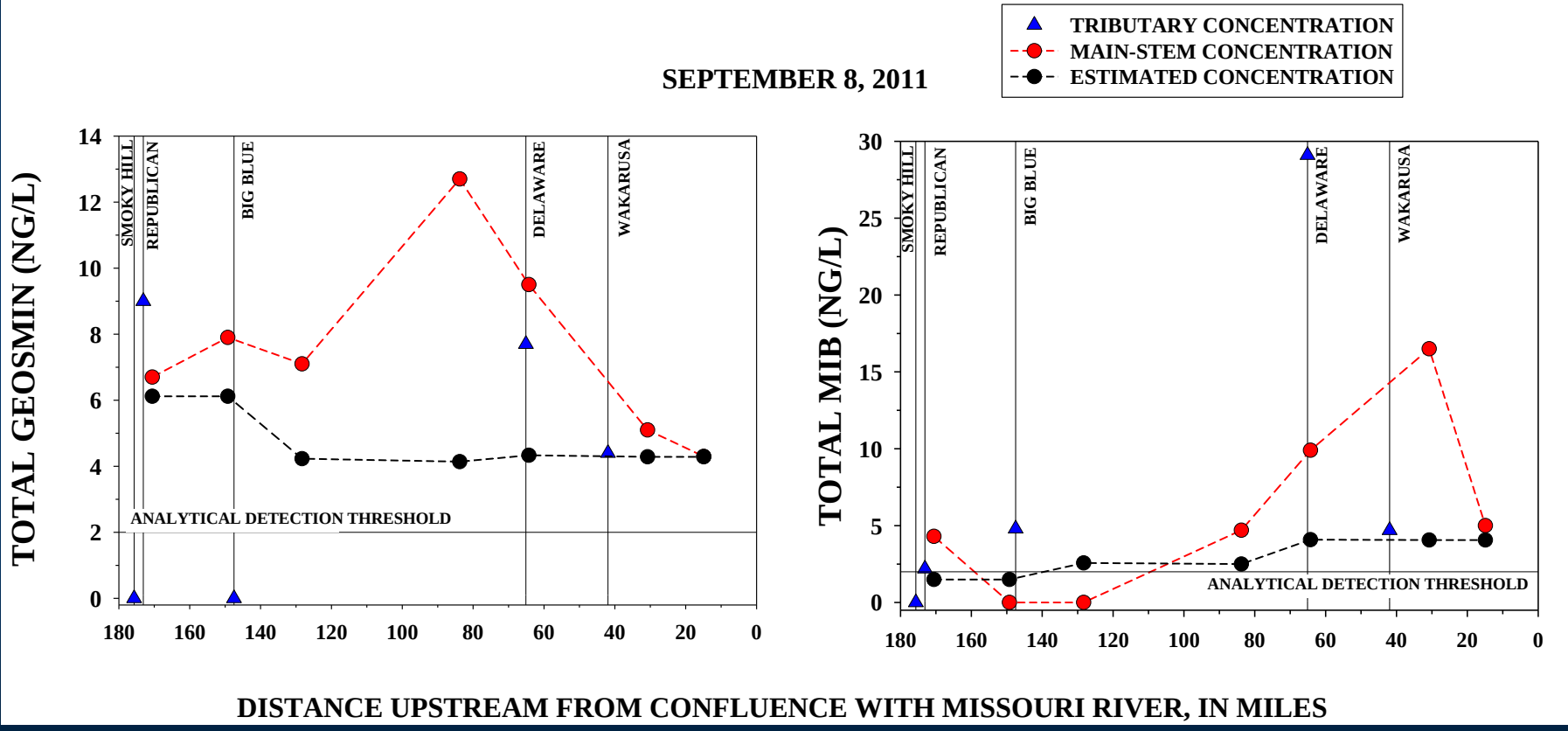
Longitudinal Patterns in Taste-and-Odor Concentrations Suggest Simple Dilution Models Are Not Sufficient to Describe Transport in the Kansas River



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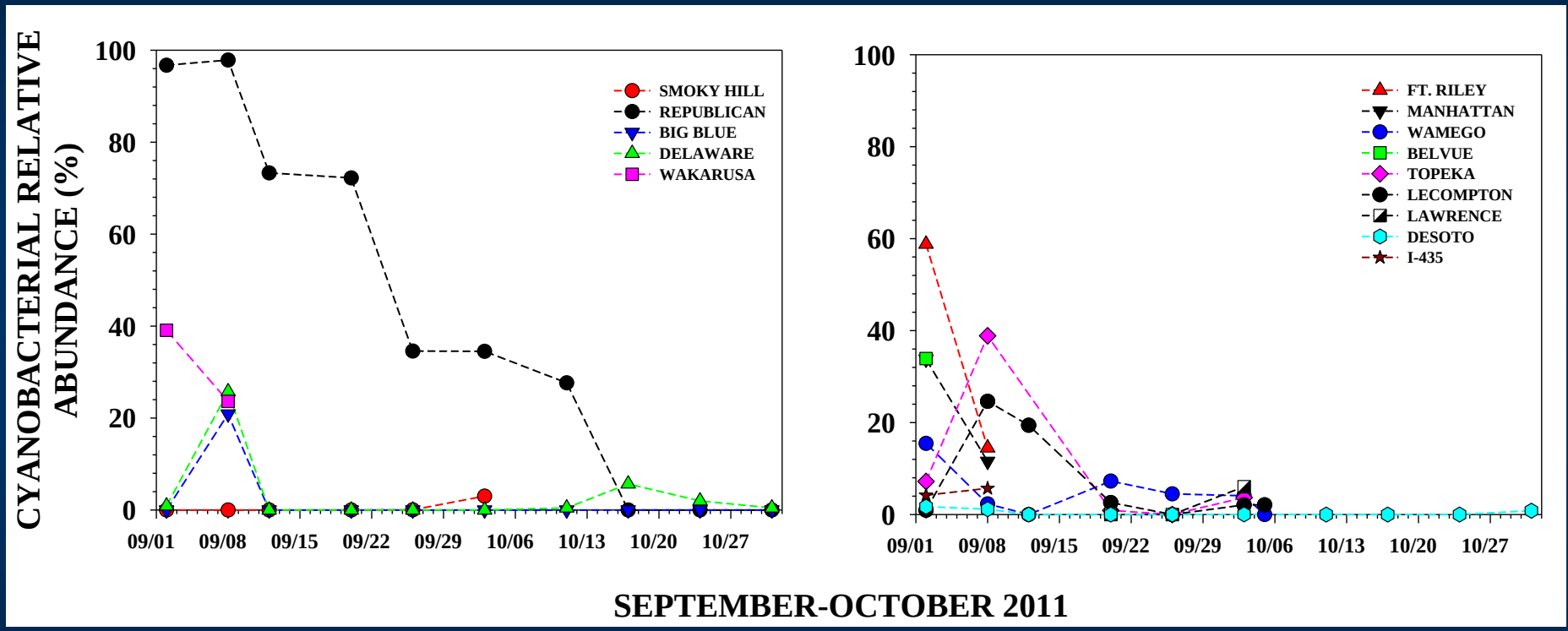
Cyanobacteria Did Not Dominate the Phytoplankton Community in the Kansas River, Even During Reservoir Releases



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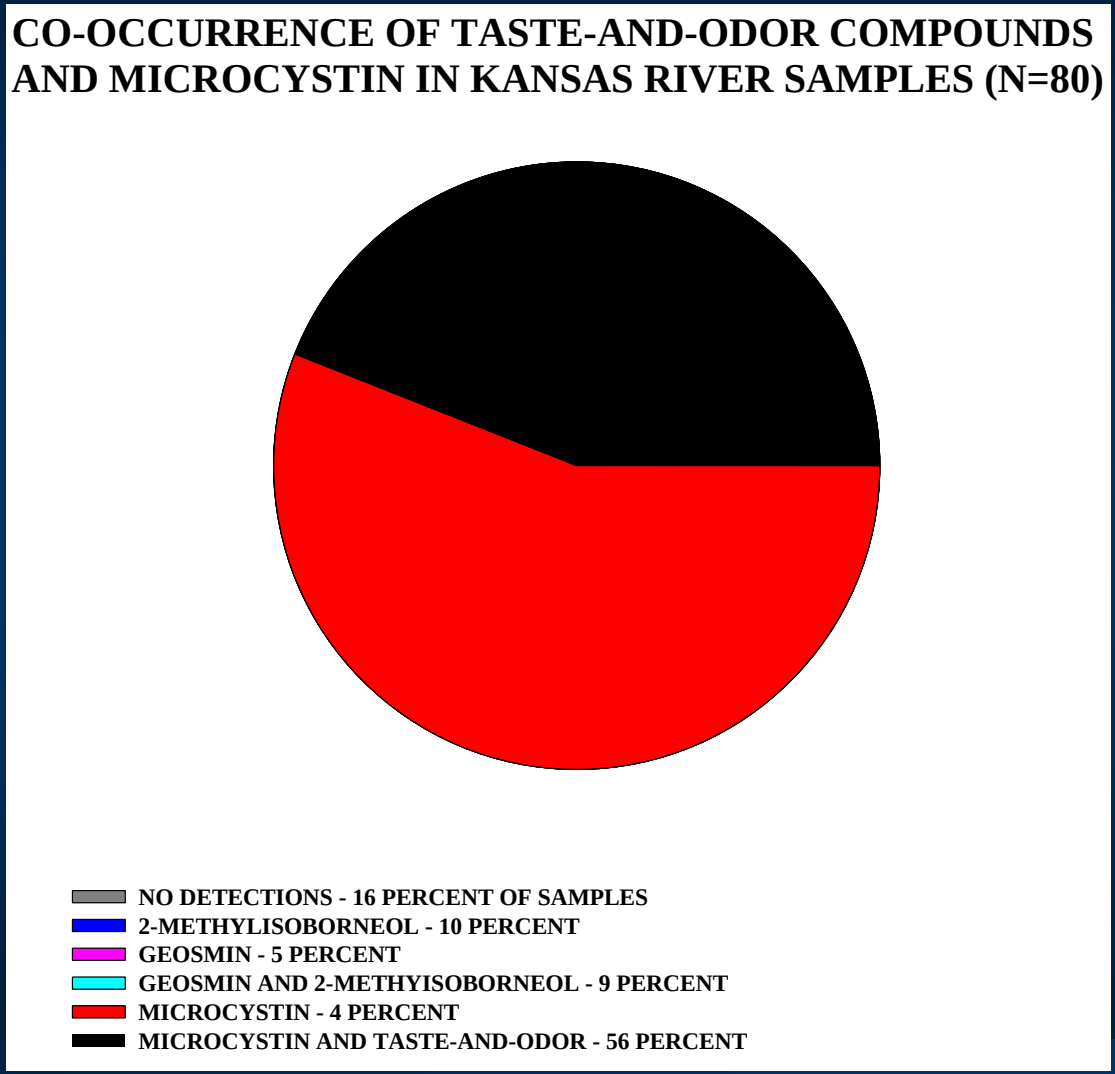
Taste-and-Odor Compounds and Microcystin Co-Occurred in 56% of the Samples Collected During September-October 2011

- 80% of samples had detectable taste-and-odor compounds (n=80).
  - 68% had detectable geosmin
  - 46% had detectable MIB
- 61% of samples had detectable microcystin (n=95)



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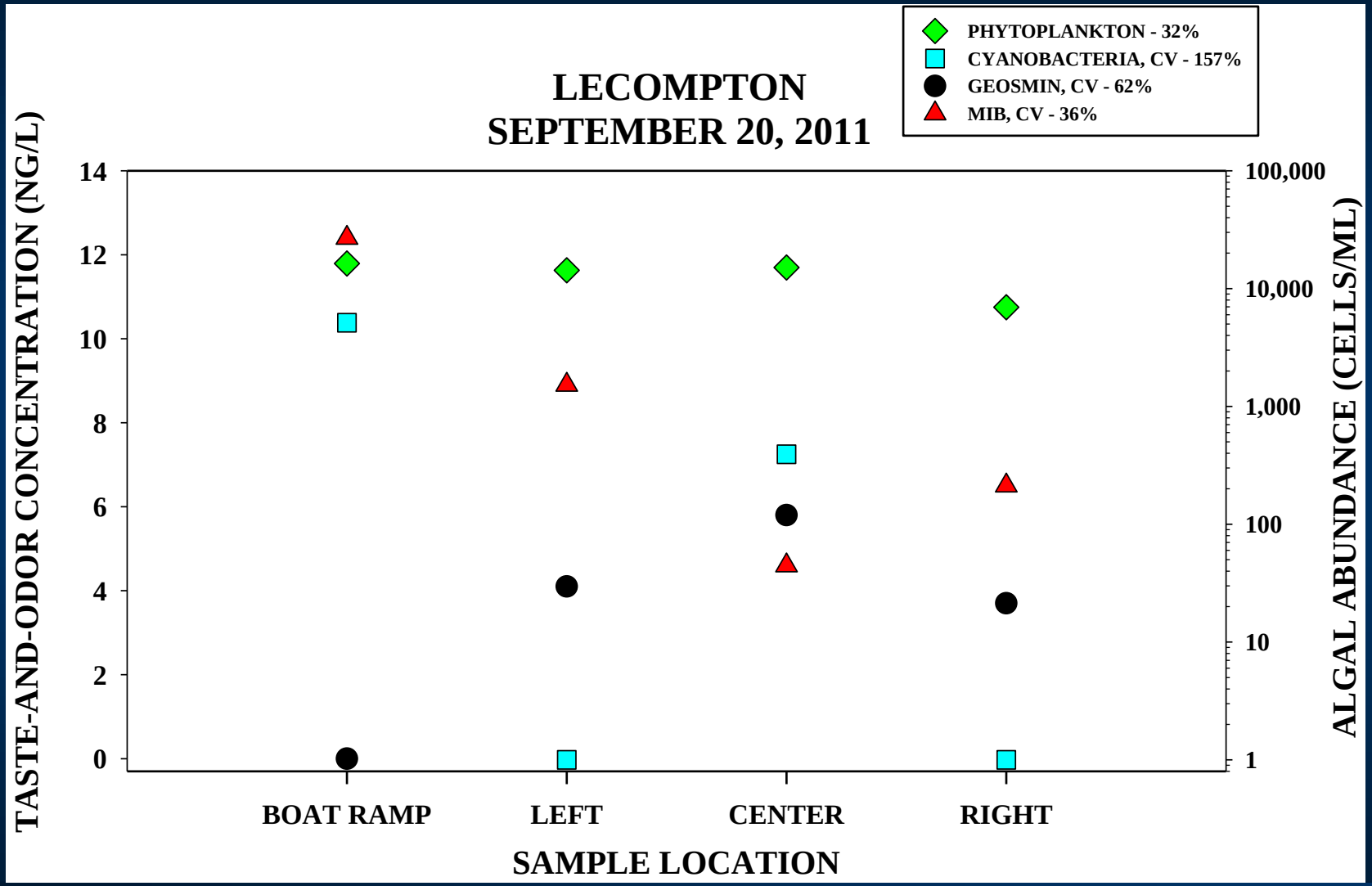
Cyanobacteria and Associated Compounds Were Variable Across the River Channel



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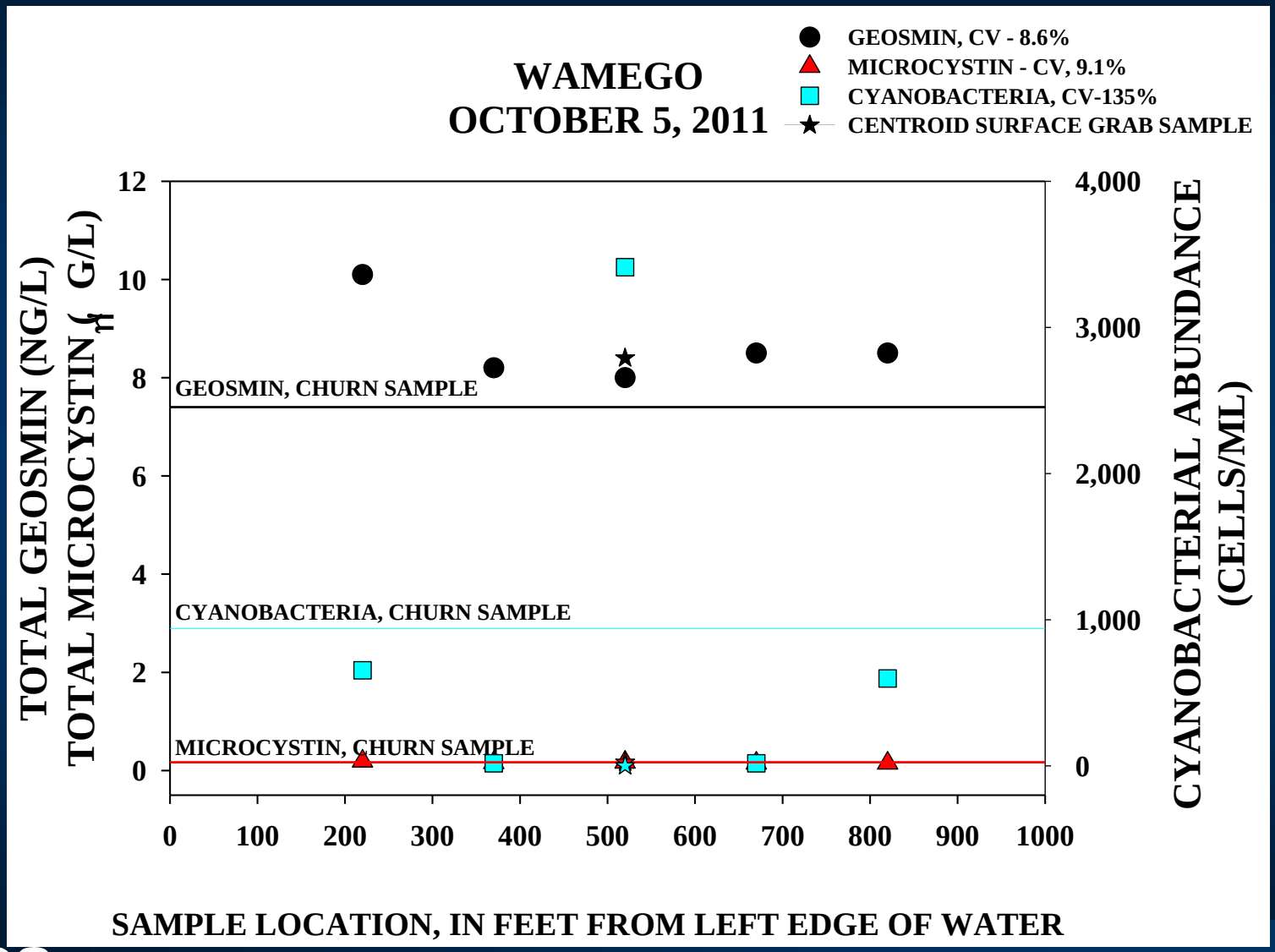
Measured Concentrations of Cyanobacteria and Associated Compounds Varied Depending on Sample Location and Method



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Conclusions

- Lake concentrations of cyanobacteria and associated compounds are not necessarily indicative of outflow conditions.
- Milford Lake was the source of microcystin in the Kansas River during September-October, 2011. The source of taste-and-odor compounds in the Kansas River was not as evident.
- Microcystins persisted in the environment long enough to be transported over 180 miles.
- Temporal patterns were unique for each individual compound.
- Understanding the influence of sample location and method is essential to the design of effective monitoring strategies and studies to quantify fate and transport.

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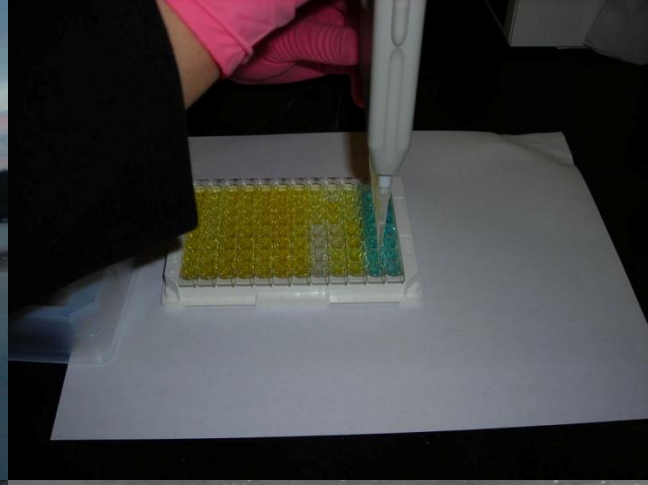


Additional Information:

http://ks.water.usgs.gov/studies/qw/cyanobacteria/

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